Agreement between California Energy Commission and mc2 Consulting, Inc.

Title: Advanced Software for Demand and Energy Reduction in California Pipelines
Amount: $399,565.00
Term: 28 months
PIER Contact: Anish Gautam
RD&D Committee: 12/3/2009

Funding

FY	Program	Area	Initiative	Budget	This Project	Remaining Balance	
08	Natural Gas	IAW	Energy Efficiency	$1,400,000	$300,475	$0	0%
09	Natural Gas	IAW	Emerging Technology Demonstration Program	$400,000	$27	$0	0%
09	Natural Gas	IAW	Natural Gas Efficiency RD&D for Industrial & Institutional Use	$1,400,000	$99,063	$400,000	28%

For the 2008 fiscal year, the total Natural Gas budget is $21 million. Within the Natural Gas program, the IAW program area budget is $1.4 million and, from this amount, $1.4 million was allocated to the Energy Efficiency budget initiative. If approved, the remaining initiative balance will be $0.00.

For the 2009 fiscal year, the total Natural Gas budget is $24 million. Within the Natural Gas program, the IAW program area budget is $1.8 million and, from this amount, $0.4 million and $1.4 million was allocated to the Emerging Technology Demonstration Program and Natural Gas Efficiency RD&D for Industrial & Institutional Use initiatives respectively. If approved, the remaining initiative balance will be $0.00 and $400,000 respectively.

Recommendation

Approve this agreement with mc2 Consulting, Inc. for $399,565.00, with $119,600 in match funding. Staff recommends placing this item on the discussion agenda of the Commission Business Meeting.

The Problem

Fluid pipelines operating in California transport gasoline, fuel oil, jet fuel, crude, other hydrocarbons, and water, all vital to the wellbeing of California's economy. These pipelines are also significant users of energy, in the form of electricity and natural gas used to run the pumps necessary for pipeline operation. In addition to significant baseline energy consumption, additional energy usage is often required by pipelines to respond to pipeline schedule requirements.

Proposed Research

This project will demonstrate the energy savings possible with use of pump optimization software and use of drag reducing agents (DRA). mc2 will retool their existing pump optimization software to provide an integrated software solution to determine:

- Optimal pump selection (electric or natural gas engine-driven) and sequence for specific fluid
- Optimal DRA concentration profile based on fluid transported
- Identify or forecast scheduled periods of high pipeline flow and energy use to optimize the schedule to reduce those periods while maintaining throughput requirements.

This technology has the potential California-wide energy savings of 23 GWh /year, coupled with a conservatively estimated 50 MW in demand reductions, and 5 thousand therms/year gas use reduction. For this project, Pacific Gas and Electric will provide the measurement and verification of all energy savings for this project.

Research Justification and Goals

This project "[will develop, and help bring to market] increased energy efficiency in buildings, appliances, lighting, and other applications beyond applicable standards, and that benefit electric utility customers" (Public Resources Code 25620.1.(b)(2)), (Chapter 512, Statues of 2006)); and supports California's goal to allocate and prioritize RD&D funding for energy efficiency and demand response, including new communication and control technologies, planning models, end-use technologies, and validation methodologies per the Energy Action Plan 2005 by:

- Measuring the effectiveness of combined use of software and DRA for the task of pipeline operations energy reduction
- Presenting this information in a form that will allow other pipeline companies to estimate the benefits of adopting this technology

These proposed award also supports the general goal of SB 1250 (Perata, Chapter 512, Statutes of 2006), which states, in part, "the Public Interest Research, Development, and Demonstration Program is to develop, and help bring to market, energy technologies that provide increased environmental benefits, greater system reliability, and lower system cost, and that provide tangible benefits to electric utility customers."

Background

The proposal was submitted through a competitive solicitation under the Emerging Technology Demonstrations Grants Program (ETDG) Opportunity Notice 08-006. This opportunity notice was structured to solicit proposals under four categories 1) Data Center, 2) Electricity Storage for Customer-side, 3) Industrial Energy Efficiency and 4) Water and Wastewater. This proposal was ranked number 3 out of 5 proposals received through the solicitation under the Industrial Energy Efficiency category.

This proposal involves three different approaches to energy reduction; two involve advanced pipeline optimization software, and the third is the use of specialized additives, called Drag Reducing Agents or DRA. Already shown to be separately effective cost-control tools, this project will show that refocusing their impact for energy use will compound their effects when used simultaneously. Due to the complexities of the hydraulic, economic, and optimization calculations, software is necessary just to help choose the best pump combinations. The next piece is the DRA which consists of long-chain

polymers that reduce the viscous friction losses in pipelines. When injected into pipeline fluids, even in low concentrations on the order of tens of parts per million, dramatically less energy is required for a given pipeline throughput. Software is also required to determine the best DRA concentration profiles. Finally, the last piece is the use of software to identify or forecast scheduled periods of high pipeline flows and/or energy use, and to optimize those schedules by reducing those periods while maintaining throughput requirements.

mc2 has developed the P.U.M.P. Optimizer software that is specifically designed for ease of adaptation to a broad variety of liquid pipelines. Thus, gasoline and refined hydrocarbon pipelines, crude pipelines, and even water pipelines can all be easily be modeled and optimized. This includes all the various types of pipeline pumps, and all electrical and fuel costing structures associated with running the pipeline. However, this type of software is focused exclusively on providing pipeline companies with the lowest operating cost solutions for meeting schedule demands and constraints. Similarly, the current state-of-the-art of DRA applications focuses on injection strategies allowing for reduction or elimination of use of one or more pipeline pumps, or for increasing pipeline throughput without costly modifications to the pipeline infrastructure (modifying or adding pumps, or replacing or adding pipe). Finally, for the added complexities of schedule optimization, an off-the-shelf schedule optimization package is not readily available, though, for this grant, mc2 is proposing subcontracting with two companies who have successfully installed schedule optimization packages for pipelines to aid in the development of schedule optimization portion of the complete software package.

This project will combine all three different energy reduction approaches and demonstrate the energy savings on ConocoPhillips' Line 200 an oil pipeline starting at Coalinga and ending in Rodeo in the San Francisco Bay Area where ConocoPhillips has a refinery. Pacific Gas and Electric will provide the necessary measurement and verification of all energy savings for this project. Once the savings from use of software and DRA are verified, the applicant will work with the Project Advisory Committee to make this technology available to all suitable pipelines in California, as well as the rest of the United States. It is estimated that this technology has the potential annual electric energy savings of 23GWh with 50MW in demand reduction and 5 thousand therms of natural gas savings.

In 2008, the oil and gas industry in California consumed over 10,000 GWh of electricity and over 3500 million therms of natural gas, by far the largest industrial end-user of energy that the PIER IAW groups works with. For years, such concerns as generation capacity, carbon caps, and global warming, were of negligible interest compared to Pipeline Company operating expense reduction and profit maximization. That situation has changed, the huge cost of adding generation and distribution infrastructure to heavily used systems is steering the industry towards finding ways of satisfying energy needs without risking recurrence of the 2002-2003 brown-outs and blackouts.